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GB 2134490 A GB 1277794 A GB 0722347 A

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(54) Storage rack for endotracheal tubes

(57) A storage rack for endotracheal tubes of a range of lumen diameters and/or lengths comprises a housing containing tubular sockets 23, each having an open end 27 fixed in an array in a panel 11 and a stop at the other end to abut against the end of a stored, endotracheal tube. Markings or colour coding on the housing and associated with the array of socket ends, indicates the size or type of endotracheal tube stored in each socket. A flanged lid (not shown) protects the endotracheal tubes projecting from the open ends 27 of the sockets, whilst still allowing visual inspection to check sizing and for a full complement of endotracheal tubes. The tubular sockets are such that replacement endotracheal tubes can be cut to a recognised 'safe' length from a longer length by inserting that length into the specific socket appropriate to the required tube length, and using the socket and extension panels 17, 18 as a template for the length of tube.

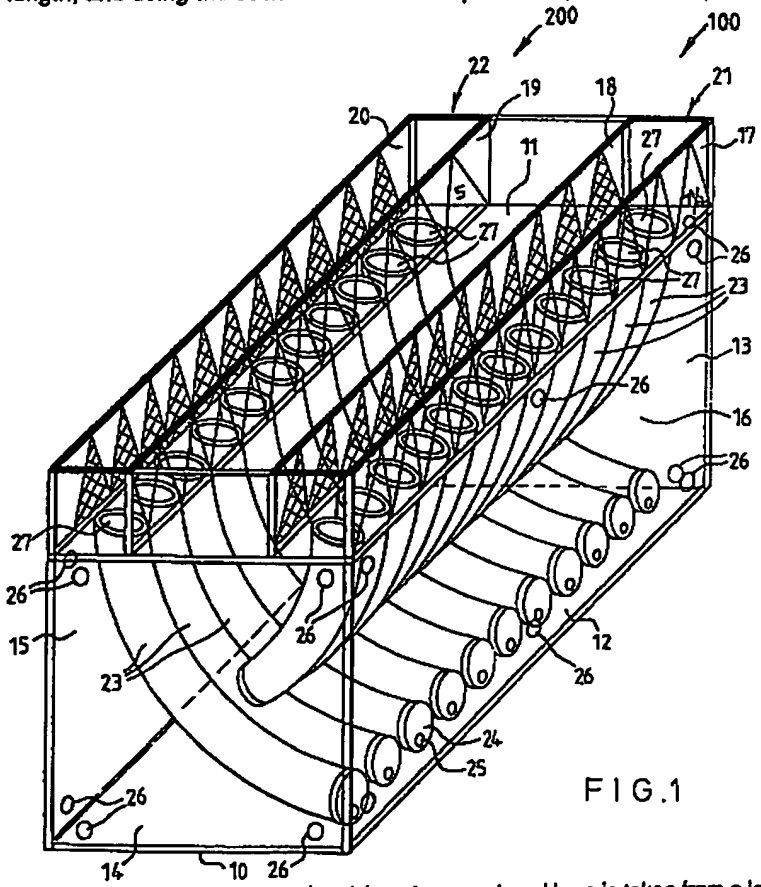

FIG.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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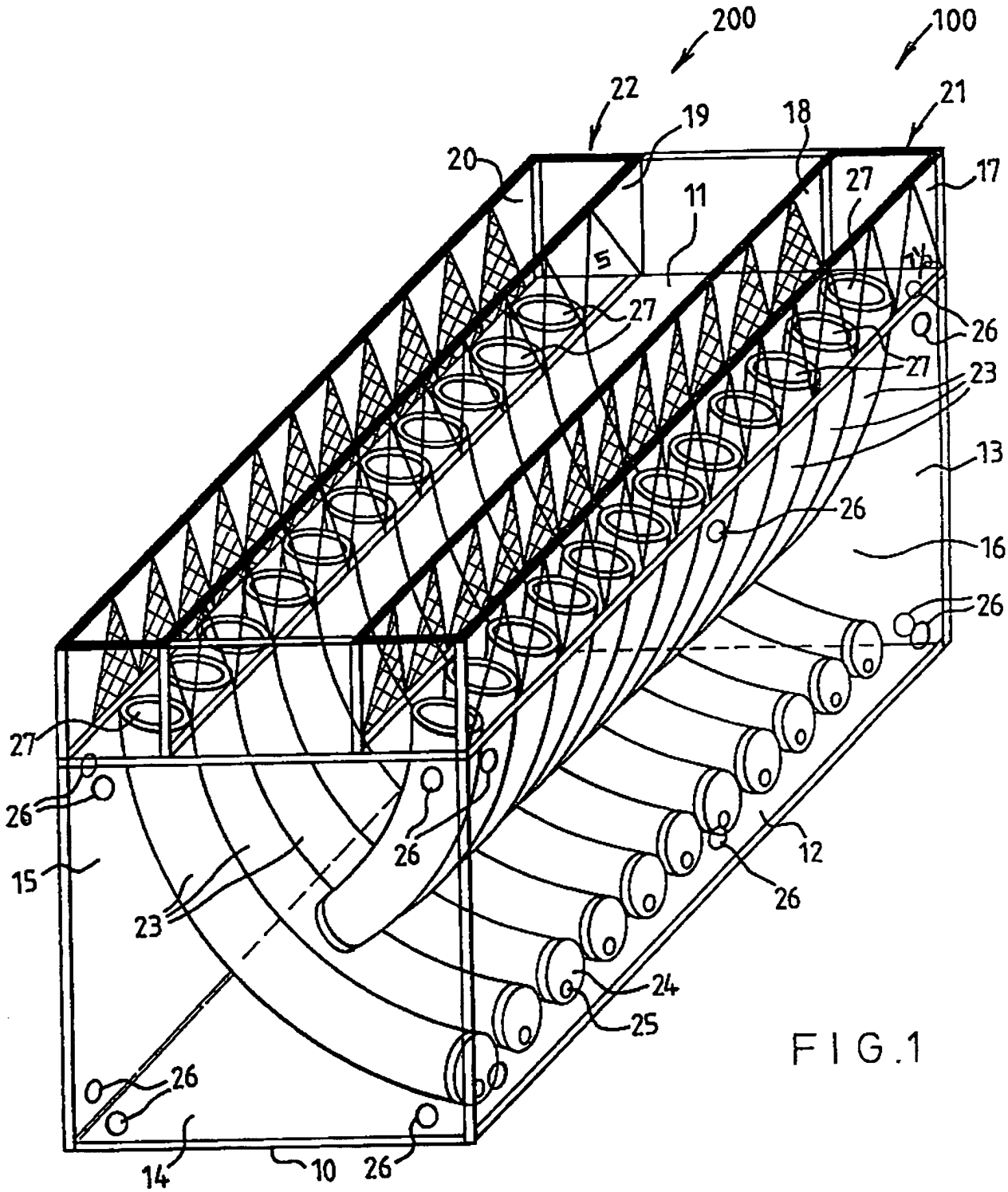


FIG.1

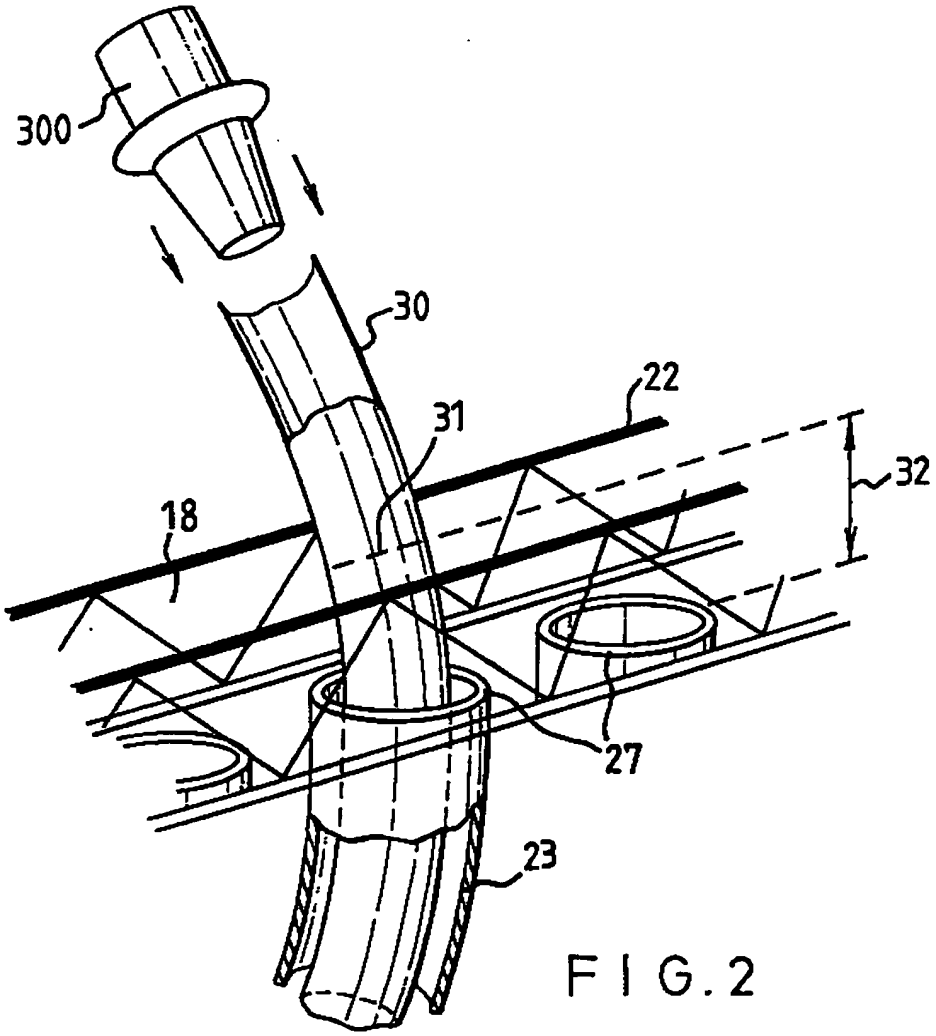
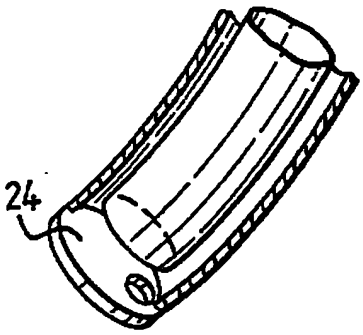


FIG.2



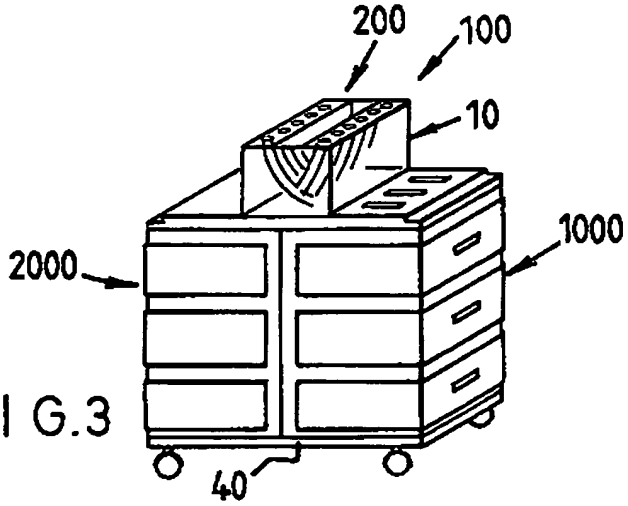


FIG.3

Storage Rack for Endotracheal Tubes

This invention relates to a storage rack for a multiplicity of endotracheal tubes of a range of lumen sizes (diameters) and/or lengths appropriate to patients of different ages, for example from neonatal through to pubescent children on the one hand and adults on the other hand.

Endotracheal tubes are used in anaesthesia and resuscitation, usually in hospitals, but also by ambulance crews, paramedics and doctors in the field. Endotracheal tubes are employed to provide a patient with a protected airway. They are supplied by manufacturers in sealed sterile envelopes (PVC), and unsterile in the case of "red rubber" endotracheal tubes. The endotracheal tubes come in a range of lumen diameters typically ranging from 2 mm to 10 mm in ½ mm increments to suit a full range of ages of patients from neonatal to large adults. The endotracheal tubes come either cuffed (primarily for adults) or uncuffed (for younger children). The plain, and uncuffed tubes may also be used for nasal intubation when prescribed.

Both the cuffed and the plain endotracheal tubes are supplied in a restricted range of lengths. Oral/nasal endotracheal tubes are supplied in long lengths which are intended to be cut to the desired length for oral or nasal intubation.

Endotracheal tubes are used in general anaesthesia in hospital theatres, where the tube is prescribed for a

certain operation or for a given condition of a patient. They can also be used in emergency situations, cardiac or respiratory arrest, and indeed anywhere it may be necessary to establish an airway with the use of such a tube. In emergency resuscitation theatres, a complete range of endotracheal tubes should always be at hand, typically laid out in a tray, on an anaesthetic machine, or on a trolley. There has been no real standardisation of the layout from hospital to hospital, and due to the large range of sizes of tubes that must be available simultaneously it can be time consuming to locate the necessary tube. Moreover, it can be very time consuming to take stock of the range of tubes and to check for necessary replacements, with the inherent danger of failure to replace tubes after use.

The diameter and length of endotracheal tubes is highly critical, especially in the neonate/child range, and accordingly failure to supply the appropriate tube in time can have severe consequences. It is not satisfactory to incur the delay involved in locating and cutting a longer tube down to size.

Further, with the arrangement currently under use in a typical hospital, the endotracheal tubes are liable to dust contamination and to infection from body fluids; there is also a danger of foreign objects entering and obstructing the lumens.

The purpose of the invention is therefore to provide a standardisation of the storage and presentation of

endotracheal tubes, for oral intubation, and to avoid the dangers of endotracheal tubes being cut too short, while minimising the risk of contamination while making it simpler to restock the range of tubes and to check for a full complement of range of tubes.

The invention provides a storage rack for a multiplicity of endotracheal tubes of a range of lumen diameters and/or lengths appropriate to patients of different ages, comprising a housing containing a like multiplicity of tubular sockets terminating in a regular array in an access panel constituting an outer surface of the housing, each socket having an open end fixed in the array and a stop at the other end to abut against the end of the corresponding endotracheal tube, a visual indication on the housing, associated with the array of socket ends, of the size or type of endotracheal tube to be stored in each socket, and means for closing the array, to protect the portions of the endotracheal tubes projecting in use from the open ends of their respective sockets, whilst still allowing visual inspection of those tube portions to check when sizing and for a full complement of endotracheal tubes, the tubular sockets being such that replacement endotracheal tubes may be cut readily to a recognised 'safe' length for oral intubation from a longer length by inserting that length into the specific socket appropriate to the required tube length, and using the socket as a template for the length of tube then attaching the appropriate adaptor ready for use.

This storage rack provides a ready identification of any endotracheal tube or tubes missing from the full complement; it also allows any such tube to be replaced readily by cutting a larger tube down to size, using the corresponding socket as a template.

Preferably, the sockets are arranged in parallel in at least one, preferably two, rows so that the array or arrays of their open ends constitute regular rows in the access panel or panels.

The sockets are preferably rigid tubes, curved so as to accommodate endotracheal tubes with their natural curvature.

The sockets are preferably arranged in two groups whose open ends form parallel rows, the groups of parallel sockets being interleaved with each other.

The housing preferably has a guide surface for cutting the tubes, the guide surface being adjacent to each access panel and spaced from the open socket ends by a spacing equal to the intended projecting length of the endotracheal tubes corresponding to those sockets, which spacing is sufficient to allow the endotracheal tubes to be grasped and pulled from their sockets and to provide the necessary visual indication of the presence of the tubes.

Preferably, the means for closing the or each array is a lid which fits over the housing's outer surface and seals against the guide surface, thereby sealing the or each access panel.

The stops at the ends of the tubular sockets conveniently have an opening for the drainage and/or circulation of disinfecting/sterilising agents into the housing, which also preferably has at least one drainage/circulation opening.

The tubular sockets are preferably formed with internal diameters such as to provide a loose but uniform fit for the correspondingly-sized endotracheal tube. This makes for an easy withdrawal and insertion without compromising accurate sizing.

The housing is preferably box-shaped, and the walls of the housing, and/or the tubular sockets, may be transparent or semi-transparent to provide further visual indications of the presence or absence of the endotracheal tubes. This also provides a visual check, when cutting a tube to size, that the tube end is abutting the stop.

A preferred embodiment will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a storage box, without the lid, drawn to a reduced scale, embodying the invention;

Figure 2 is a perspective view, partly in section, and drawn approximately to scale, of part of the storage box of Figure 1, together with a length of endotracheal tubing ready to be cut to size; and

Figure 3 is a perspective view, to a greatly reduced scale, of a trolley for use in a resuscitation operating

theatre, on which is mounted the storage box of Figure 1.

The storage rack shown in Figure 1 is in the form of a box 10. The box has a housing which, in the prototype illustrated, is of transparent perspex but may be of any convenient material. The housing 10 has a top surface 11, a floor 12, front and rear walls 13,14, and left- and right-hand walls 15,16. The vertical walls 13,14,15 and 16 have drainage holes 26 at their top and bottom corners.

Two rows of suitable plastics, semi-transparent tubular sockets 23, mutually interleaved, are contained within the housing. The first row 100 comprises twelve such sockets, intended to accommodate plain endotracheal tubes ranging in length from tubes appropriate for neonatal patients through to child patients at around the age of puberty. These twelve sockets are arranged in parallel, and are curved with a radius of curvature of around 40 cm to suit the natural curvature of endotracheal tubes. Each socket 23 has an upper open end 27 which is fixed in an array constituting part of the upper surface 11. The upper wall 11 therefore has twelve circular openings corresponding to the open ends 27 of the tubular sockets 23.

The second set 200 of tubular sockets 23 comprises eleven parallel sockets intended for accommodating cuffed endotracheal tubes appropriate for children when a cuffed tube is prescribed, and adults. As in the case of the first set of sockets 100 the length of the sockets 23 changes progressively from one end of the housing to the

other end; preferably also the internal diameter of the sockets changes progressively, or in steps, from one end of the housing to the other, so that the endotracheal tubes should be a reasonably loose fit.

The lower ends 24 of all the sockets 23 are closed except for a small drainage opening 25 for sterilising fluid or the like. These closures provide a stop for the ends of endotracheal tubes inserted into the sockets.

Extension panels 17 and 18 project upwardly from the edges of the access panel to the first set 100 of tubular sockets; similarly, extension panels 19 and 20 project upwardly from the side edges of the access panel for the second set 200 of sockets. These panels 17,18,19 and 20, together with end walls extending from the housing end walls 13 and 14, define "troughs" which surround and protect the access panels. The rectangular upper edges 21 and 22 of these extension panels also constitute guide surfaces for the cutting of elongate endotracheal tubing, using the storage box as a template, as described in greater detail below.

A transparent rectangular lid (not shown), with side flanges, fits sealingly over the top of the housing 10, in sealing engagement with the guide surfaces 21,22, thereby to seal the access panels.

The region between the inner extension panels 18 and 19 and above the upper wall surface 11 constitutes a tray for the storage of essential intubating aids and equipment such as laryngoscopes, introducing stylets, catheter

mounts, air syringes, tape and scissors, also airways and nasal endotracheal tubes. This storage tray is of course also closed by the lid.

The extension panels 17 and 20 are marked clearly with numerals indicating the lumen size of the endotracheal tube which is intended to be stored in each corresponding socket. In this example, the eleven sockets for cuffed tubes are labelled 5,5½,6,6½,7,7½,8,8½,9,9½ and 10; the plain uncuffed tubes are labelled 2,2½,3,3½ and 4 (neonate), and 4½,5,5½,6,6½,7 and 7½ (child). For further assistance, the age of each patient appropriate for the size of tube may also be indicated adjacent the tube size: for example, age 1 corresponds to size 4½; age 2 to size 5; ages 3,4 and 5 to size 5½; age 6 to size 6; ages 7-9 to size 6½; age 10 to size 7; and ages 11 and 12 to size 7½. Further assistance may be given by colour coding. These labels are intended as a 'rough' guide only as children's age/weight/size can vary dramatically.

By way of example, a recognised method of sizing endotracheal tubes correspond to a formula which gives the lumen internal diameter in mm as one quarter of the patient's age plus 4½, and which gives the endotracheal tube's length in cm as one half the patient's age plus 12. Since these formulae may not always be readily known by all the staff involved, these extra visual indications can be very useful as a guide.

With reference now to Figure 2, the method of cutting an endotracheal tube to size will now be

described. Although a plain tube 30 is illustrated, this method applies equally to a cuffed tube. The tube 30 is inserted as far as possible into the appropriate socket 23, so that the end of the tube 30 abuts against the stop 24, as shown in Figure 2. This can be confirmed by direct vision or by feel. The guide surface 22, which is a predetermined spacing 32 from the plane of the access panel in which the open ends 27 of the sockets are all located, is used as a template. Thus the tube 30 is either marked at position 31 for subsequent cutting upon removal from the socket or the tube 30 is immediately cut in situ at the position 31. This ensures that the endotracheal tube is cut at precisely the required length for oral intubation and not at too short a length for safety, leaving a portion of length, equal to the spacing 32, projecting from the open end 27 of the socket 23. The appropriate adaptor 300 is inserted, ready for use, into the end of the tube.

The storage box, being divided essentially into two halves 100,200 appropriate respectively for younger and older patients, lends itself to use on a trolley 40 similarly divided into two halves 1000,2000, devoted respectively to the storage of items for paediatric use and for adult use, as shown schematically in Figure 3. The trolley may be rotated to provide access only to those drawers in the appropriate section (1000,2000), this giving clear access to the appropriate portion 100,200 of the endotracheal tube storage box. This provides a

further safeguard against incorrect selection of an endotracheal tube, and improves the speed of access.

Although in this example the storage rack is in the form of a box, it will be appreciated that the precise shape may be selected to suit the required range of sockets. Indeed, the ends of the sockets may be arranged in other types of array, and need not be in straight rows. Although the access panels in this example face upwardly, this is not essential and they could be formed on a side surface of a storage rack, for example.

CLAIMS

1. A storage rack for a multiplicity of endotracheal tubes of a range of lumen diameters and/or lengths appropriate to patients of different ages, comprising a housing containing a like multiplicity of tubular sockets terminating in a regular array in an access panel constituting an outer surface of the housing, each socket having an open end fixed in the array and a stop at the other end to abut against the end of the corresponding endotracheal tube, a visual indication on the housing, associated with the array of socket ends, of the size or type of endotracheal tube to be stored in each socket, and means for closing the array, to protect the portions of the endotracheal tubes projecting in use from the open ends of their respective sockets, whilst still allowing visual inspection of those tube portions to check when sizing and for a full complement of endotracheal tubes, the tubular sockets being such that replacement endotracheal tubes may be cut readily to a recognised 'safe' length for oral intubation from a longer length by inserting that length into the specific socket appropriate to the required tube length, and using the socket as a template for the length of tube then attaching the appropriate adaptor ready for use.

2. A rack according to Claim 1, in which the sockets are arranged in parallel in at least one row so that the array or arrays of their open ends constitute regular rows in the access panel or panels.

3. A rack according to Claim 2, in which there are two such parallel rows.

4. A rack according to Claim 1, 2 or 3, in which the sockets are rigid tubes, curved so as to accommodate endotracheal tubes with their natural curvature.

5. A rack according to any preceding claim, in which the sockets are arranged in two groups whose open ends form parallel rows, the groups of parallel sockets being interleaved with each other.

6. A rack according to any preceding claim, in which the housing has a guide surface for cutting the tubes, the guide surface being adjacent to each access panel and spaced from the open socket ends by a spacing equal to the intended projecting length of the endotracheal tubes corresponding to those sockets, which spacing is sufficient to allow the endotracheal tubes to be grasped and pulled from their sockets and to provide the necessary visual indication of the presence of the tubes.

7. A rack according to any preceding claim, in which the means for closing the or each array is a lid which fits over the housing's outer surface and seals against the guide surface, thereby sealing the or each access panel.

8. A rack according to any preceding claim, in which the stops at the ends of the tubular sockets have an opening for the drainage and/or circulation of disinfecting/sterilising agents into the housing, which also has at least one drainage/circulation opening.

9. A rack according to any preceding claim, in which the tubular sockets are formed with internal diameters such as to provide a loose but uniform fit for the correspondingly-sized endotracheal tube.

10. A rack according to any preceding claim, in which the walls of the housing, and/or the tubular sockets, are transparent or semi-transparent to provide further visual indications of the presence or absence of the endotracheal tubes.

11. A storage rack for endotracheal tubes, substantially as described herein with reference to the accompanying drawings.

12. A storage rack according to any preceding claim, fitted with appropriately-sized endotracheal tubes.

13. A method of preparing an endotracheal tube comprising inserting a length of tubing in an appropriately-selected socket of the rack of any preceding claim, using the socket as a template to cut the tubing to size, and attaching an adaptor to the cut tubing.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
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Relevant Technical fields

(i) UK Cl (Edition K) A5R (REJ); B8P (PE2G), (PE2X)

(ii) Int Cl (Edition 5) A61B; B65D

Search Examiner
R J WALKER

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI, CLAIMS

Date of Search
23 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1-13

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2134490 A (CONACHER) See eg. Figure 1	1
X	GB 1277794 (BEHRINGWERKE AG) See whole document	1, 2, 3, 6, 7, 9
X	GB 722347 (BLASDON) See eg. Figure 1	1, 2, 3, 7

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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